

Vermont-PASS Science Blueprint: Appendix - Grade 11

Preparing for the Vermont-PASS Assessment

Detailed administration manuals will accompany the Vermont-PASS assessment. However, there are several things that would be beneficial for teachers, administrators and test coordinators to consider ahead of time and are therefore included in this Blueprint. It is also important for test coordinators and teachers who will be administering the assessment to attend pre-assessment training sessions that will be conducted regionally prior to the testing window.

Vermont-PASS Test Coordinators

It is the responsibility of the test coordinator to ensure that all teachers administering the assessment understand the test administration and security procedures. The test coordinator must receive, store in a locked facility, and return all test booklets. The test coordinators will also be responsible for distributing the hands-on materials for the performance task investigations. These materials will be shipped in bulk, and will need to be separated into individual student set ups. In small elementary schools, this task will not be very time consuming. However, in larger schools, particularly high schools, a test coordinator might be dealing with hundreds of student hands-on material sets. It is recommended that adequate time be set aside for this organizational task. Larger schools might also consider utilizing student lab assistants to help organize the hands-on materials.

Students

Teachers are encouraged to share the Vermont-PASS practice tests with their students in order to familiarize them with the components of the test. Teachers might also want to remind students that although scientists frequently work in collaborative groups, students will be asked to work alone on the assessment performance task. This is to provide an accurate measure of what each student knows and is able to do.

Teachers

It is recommended that teachers administering the Vermont-PASS assessment become familiar with the test, particularly the performance task investigation prior to the scheduled administration time. It is also recommended that the performance task be administered in a regular lab or classroom environment. When teachers review the task and materials they can decide if they want to use their customary materials management strategies or devise something different for the Vermont-PASS materials.

Scheduling

As mentioned above, it is recommended that the performance task be administered in a science lab or classroom environment even if the school needs to combine groups for the other parts of the assessment. This strategy also alleviates problems associated with providing non-supplied materials such as water or eye protection.

Name: _____

“Bungee Jump” Performance Task Grade 11



*LEAPING BUNGEE CORDS
73 Short Rope Lane
Bounceville, Vermont 05999*

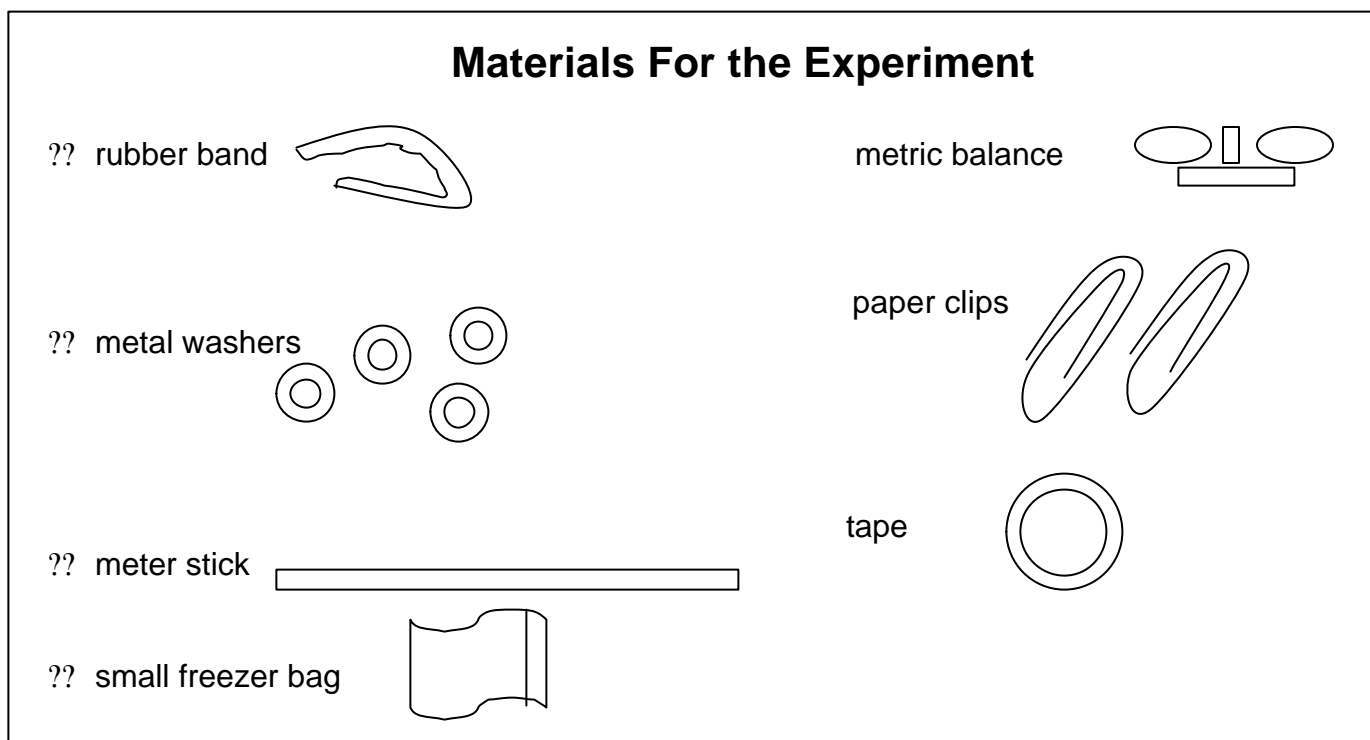
Memo to: Safety Engineering Department
Memo From: I. M. Jumper, President
Subject: Bungee cord safety

It seems clear that heavier people will stretch a bungee cord farther. However, the exact relationship between the weight and cord stretch is not known. Our new line of bungee jumping cords will be released next month. To assure the safety of the jumpers who will use the cords and protect the liability of the operators of the bungee jumping apparatus, we must include information that indicates how long the cord will stretch for jumpers of various weights.

Using a scaled down model of the bungee jumping apparatus, you will determine how increasing weight affects the change in the stretch of the cord. Your investigation question is **“How does increasing weight attached to the bungee cord compare with the change in the length of the cord?”**

1) Using the information in the company memo and your understanding of forces, formulate a hypothesis about increasing weight attached to the bungee cord compared to the change in length of the cord. Explain your thinking.

Follow this experimental procedure in order to test your hypothesis:



Procedure For the Experiment

- a. Bend two paper clips into an “S” shape
- b. Tape one paper clip to the table
- c. Tie one end of the rubber band to the paper clip
- d. Tie the other end of the rubber band to the second paper clip and hang the plastic bag from the paper clip
- e. Measure length of the rubber band **unstretched** in centimeters
- f. Place one weight on the lower paper clip. Gently lower weight allowing the rubber band to stretch until the weight comes to rest. Measure and record the new length of the rubber band.
- g. Add additional weights one at a time and measure and record the length of the rubber band after each new weight is added.

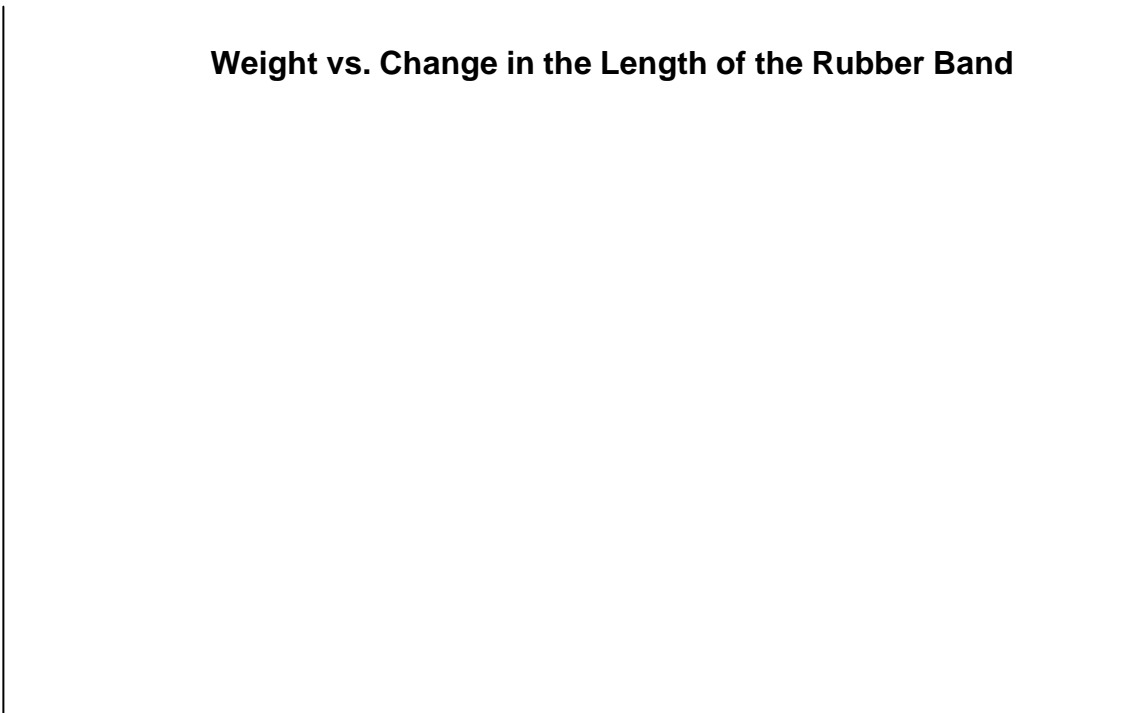
2) Record your results in the tables below.

Bungee Cord Lengths

Mass	Length of rubber band (cm)	Change in length of rubber band (cm)

3) Use the data from your table to graph the weight vs. change in length and draw a best-fit curve.

Weight vs. Change in the Length of the Rubber Band



- 4) Look carefully at the intervals between the points on your graph. Describe how the length of the cord changes as the amount of weight increases, especially as the weight gets very heavy.

- 5) Does your data support (or refute) your prediction? Use evidence from the experiment to explain your answer.

- 6) Explain why the data from this experiment might not be sufficient to make a recommendation to the Leaping Bungee Company about the safety of their bungee cords?

7) Describe the type of evidence that still needs to be collected in order to provide a more informed decision regarding the safety of the system.

8. Draw and label a diagram of the two forces acting on the jumper when the jumper comes to rest. Use arrows to represent the magnitude and direction of each force.

Vermont-PASS Sample Test

Grade 11 Performance Task and Alignment With PASS Performance Task Development Template

“Bungee Cord”

1. Scenario:

Leaping Bungee Cords
73 Short rope Lane
Bounceville, Vermont 05999

Memo to: Safety Engineering Department
Memo From: I. M. Jumper, President
Subject: Bungee cord safety

VT Framework: Inquiry – 7.1 bbb., cc., dd.
Space, Time, Matter – 7.12 dd.
Notation and Representation- 1.17aaa.

NSES: Inquiry – 1.1, 1.3, 1.4, 1.5, 2.4, 2.5, 2.6
Physical Science – 4.1, 4.3

It seems clear that heavier people will stretch a bungee cord farther. However, the exact relationship between the weight and cord stretch is not known. Our new line of bungee jumping cords will be released next month. To assure the safety of the jumpers who will use the cords, and protect the liability of the operators of the bungee jumping apparatus, we must include information that indicates how long the cord will stretch for jumpers of various weights.

Using a scaled down model of the bungee jumping apparatus, you will determine how changes in weight affect the stretch of the cord. Your investigation question is **“How does the change in weight attached to the bungee cord compare with the change in the length of the cord?”**

2. Problem Statement:

“How does the change in weight attached to the bungee cord compare with the change in the length of the cord?”

The elongation of an ideal spring is proportional to the force on it. The actual relationship, also known as Hooke's Law, is $f = -kx$, where f is the force, k is the spring constant and x is the distance of elongation. Unlike an ideal spring, a rubber band (or bungee cord) has a more complex relationship between force and elongation. The experimentally derived relationship will be greater than linear and less than cubic. (x^3).

The

intent of this problem is for students to experimentally explore the stretch length vs. weight relationship. It is not expected for students to recognize the exact mathematical relationship, only that it is non-linear.

3. Prediction-Hypothesis

1) Using the information in the Lovers’ Leap memo and your understanding of force and motion, formulate a hypothesis about the change in weight attached to the bungee cord compared to the change in length of the cord. Explain your thinking.

Scoring Guide:

Key Elements: 1. Hypothesis includes cause (change in weight,) and effect (change in cord length)
2. Hypothesis states a rational based on the scenario or prior knowledge.

Score Points: 2 points = 2 key elements
1 point = 1 key element

Students can receive points for both key elements even if their reasoning is flawed. If students collect accurate data, it will be important for them to address the flaws when they answer question #5.

4. Experiment:

Materials For the Experiment

?? rubber band
 ?? metric balance
 ?? paper clips
 ?? metal washers
 ?? tape
 ?? meter stick
 ?? freezer bag

?? Use a thin rubber band that can be stretched a long distance without straining. If the band is strained the data will be distorted. Good quality rubber band material for this task can be obtained from Midwest Products Co. Educational Products Division (8003483497). Item # 378 , 1/8" band. It comes in 48-foot lengths that can be cut to the desired size.

?? The test set up must allow the rubber band to stretch easily without hitting the floor or another object. It may be necessary to hang the rubber band on a chair placed on a table.

?? Choose a set of regular weights approximately 50 grams each. Choose weights that will easily fit into the freezer bag.

Procedure For the Experiment:

- ?? It is important to perform this experiment several times with the materials that you collect from your own site before asking students to complete this task.
- ?? Though rubber bands are recommended, the band should be cut so that only one strand of rubber band is used for this task.
- ?? Ensure that the data collected follows a CURVE. If the curve flattens out at higher weights, the rubber band is probably strained and you will need to use a stronger rubber band.

5. Data collection and organization:

2) Record your results in the tables below.

Scoring Guide:

Key Element: Student accurately enters data in all three columns.

Score Points: 1 point= 1 key element

3) Use the data from your table to graph the weight vs. change in length and draw a best-fit curve.

Scoring Guide:

Key Elements:

1. Student accurately labels the independent variable (weight) on the X axis and the dependent variable (? length) on the Y axis.
2. Student accurately assigns a scale for the axes.
3. Student accurately plots data points
4. Student draws a best-fit curve that demonstrates a non-linear relationship.

Score Points: 4 points=4 key elements

3 points=3 key elements

2 points=2 key elements

1 point= 1 key element

7) Use of Evidence:

- 6) Look carefully at the intervals between the points on your graph. Describe how the length of the cord changes as the amount of weight increases, especially as the weight gets very heavy.

Scoring Guide:

Key Element: As you increase the weight, the length of the cord increases exponentially **or** (doubling **or** non-linear **or** gets a lot longer each time)

Score Points: 1 point = 1 key element

- 7) Does your data support (or refute) your prediction? *Explain your thinking*

Scoring Guide:

Key Elements: 1. Response clearly cites evidence from the experiment as supporting or refuting the hypothesis.
2. Response accurately compares the weight of the object to the stretch of the cord.

Score Points: 2 points = 2 key elements
1 score point = 1 key element

- 6) Explain why the data from this experiment might not be sufficient to make a recommendation to the Leaping Bungee Cords Company about the safety of their bungee cords?

Scoring Guide:

Key Elements: Trials were not repeated **or** the model used only light weights and small bands **or** extrapolation might not be accurate when the elastic cord is changed **or** model measured at resting position, not maximum stretch **or** other variables such as air friction could be significant.

Score Points: 3 points = 3 or more key elements
2 points = 2 key elements
1 point = 1 key element

- 7) Describe the type of evidence that still needs to be collected in order to provide a more informed decision regarding the safety of the system.

Scoring Guide:

Key Element: Student chooses a limitation of the model and describes the type of evidence that still needs to be collected. For instance, if the student chose the light weights and small bands as the limitation, he or she might suggest that data needs to be collected for weights within the range of human weight and cords that will support those weights in order to see if the best fit curve for the higher weights matches the curve for the model.

Score Points: Student receives a score point for every set of evidence that would logically inform the limitation cited.

- 8) Draw and label a diagram of the forces acting on the jumper when the jumper comes to rest. Use arrows to represent the magnitude and direction of each force.

Scoring Guide:

Diagram of jumper with two arrows one pointed upward and one pointed downward of equal length. The two forces are gravity pulling downward and the bungee cord (elasticity) pulling upward.

Key Elements: 1 arrows are equal and opposite
and 2 identifies and clearly labels gravity
Score points 3 identifies and clearly labels upward force (cord, elasticity)

Constructed Response Questions

Directions:

You will be completing two constructed response questions.

River Study
And
Sugar Water

Please read each question and write your answers. Your answers will be judged on
?? How well you show your understanding of science; and
?? How well you can explain it to others.

Write your response in the space after each question. You may include a diagram to help explain your answer.

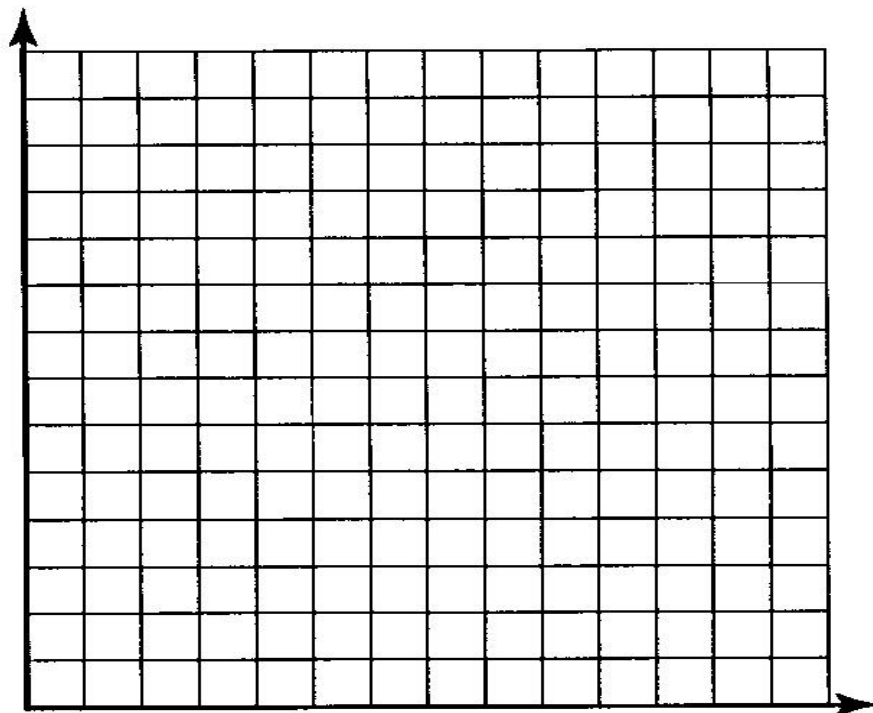
Students from a Vermont high school wanted to monitor the ecology of a local river system. They collected data showing the relationship between the level of dissolved oxygen and water temperature over time. The data is represented in the table below.

**AVERAGE DISSOLVED-OXYGEN LEVELS
FOR MAY–SEPTEMBER 1995**

Month	Dissolved-Oxygen Level (ppm)	Water Temperature (°C)
May	13	12
June	10	13
July	8	14
Aug	7	18
Sept	5	19

- 1) Make a graph that shows the relationship between the level of dissolved oxygen and the water temperature of the river. Be sure to include a number scale and labels for each axis.

**RELATIONSHIP BETWEEN DISSOLVED OXYGEN
AND TEMPERATURE IN A VERMONT RIVER**

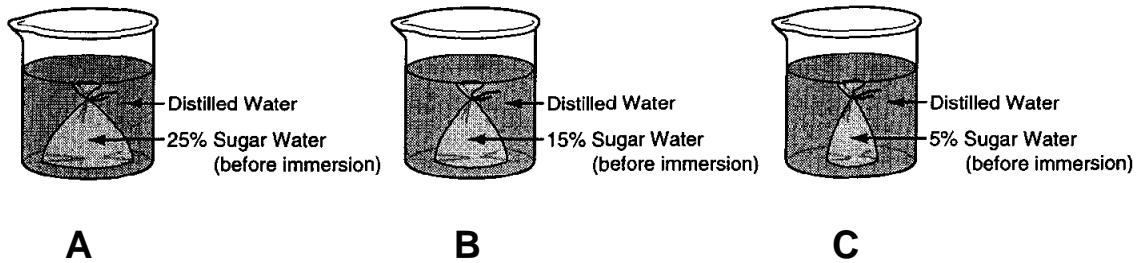


- 2) Use your graph to describe the relationship between the dissolved-oxygen levels and the water temperature of this Vermont river.

- 3) With your graph in mind, make a hypothesis about what would happen to the **breathing rate** of fish confined to an area of the river warmed by water from a factory. Explain the thinking that led to your hypothesis.

- 4) Imagine that you have an aquarium with a heater and a thermostat. Design an experiment to test your prediction about the breathing rate of fish in the area of the river receiving warm water, using the aquarium, heater, and thermostat. Describe the sequence of steps in the procedure of your experiment.

Three different concentrations of sugar and water were put into individual semi-permeable bags (permeable to water but not to sugar). These bags were weighed and then submerged in three different beakers of equal quantities of distilled water.



After 30 minutes, each semi-permeable bag was weighed again and the following results were recorded:

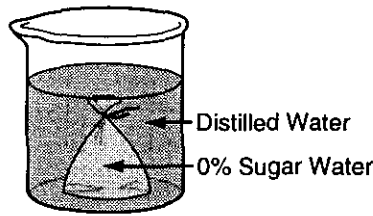
Bag A: 38% gain in weight

Bag B: 16% gain in weight

Bag C: 3 % gain in weight

1) Why did the three bags gain weight?

What caused Bag B to gain more weight than Bag C?



- 2) Predict what will happen to the weight of a semi-permeable bag containing pure distilled water (0% sugar-water solution) when it is put into a beaker of distilled water for 30 minutes.

Explain the reason for your prediction.

- 3) There are two beakers; one beaker is filled with 15% sugar water and the other with only distilled water. Explain how you could use two identical semi-permeable bags, each filled with the same amount of distilled water, to determine which beaker contains the sugar water.

- 4) Explain how the balance necessary for life is maintained in cells by processes like those you described in questions 1, 2, and 3.

Vermont-PASS Sample Test Grade 11 Constructed Response Questions

River Study

VT Framework: Inquiry – 1.20, 7.1cc., dd.

Living World – 7.13 aa.

NSES: Inquiry – 1.2, 1.4

Life Science 6.2

- 1) Make a graph that shows the relationship between the level of dissolved oxygen and the water temperature of the river. Be sure to include a number scale and labels for each axis.

Scoring Guide:

Key Elements:

?? Graph contains connected lines and dots (4or5 dots accurately plotted). No credit for bar graphs

?? Number scales are present and accurate.

?? Each axis is labeled (Dissolved Oxygen and °C or Temperature °C).

Score Points:

3 points = 3 key elements

2 points = 2 key elements

1point = 1 key element

- 2) Use your graph to describe the relationship between the dissolved-oxygen levels and the water temperature of this Vermont river.

Scoring Guide:

Key Elements:

?? As water temperature increases, dissolved-oxygen levels decrease.

Score Points:

1point = 1 key element

- 3) With your graph in mind, make a hypothesis about what would happen to the **breathing rate** of fish confined to an area of the river warmed by water from a factory. Explain the thinking that led to your hypothesis.

Scoring Guide:

Key Elements:

?? It would increase
and

?? Warmer water has less dissolved oxygen, causing the fish to breathe faster.

?? It would stop
And

?? Warmer water has less dissolved oxygen and might cause the fish to die from oxygen deprivation.

Score Points:

2 points = 2 key elements

1point = 1 key element

- 4) Imagine that you have an aquarium with a heater and a thermostat. Design an experiment to test your prediction about the breathing rate of fish in the area of the river receiving warm water, using the aquarium, heater, and thermostat. Describe the sequence of steps in the procedure of your experiment.

Scoring Guide:

Key Elements:

- ?? Measure the breathing rate of the fish
- ?? Gradually increase the temperature of the water in the aquarium
- ?? Keep all other conditions in the aquarium constant.
- ?? Measure the breathing rate of the fish after the increase in temperature.

Score Points:

- 4 points = 4 key elements
- 3 points = 3 key elements
- 2 points = 2 key elements
- 1point = 1 key element

Sugar Water

VT Framework: Living World – 7.13 aaa.

NSES: Life Science 1.1

- 1) Why did the three bags gain weight?

What caused Bag B to gain more weight than Bag C?

Scoring Guide:

Key Elements:

- ?? The bags gained weight by water flowing into them (from the beakers).
Or
Osmosis
- ?? More sugar in B caused more water to flow into it then into C.

Score Points:

- 2 points = 2 key elements
- 1point = 1 key element

- 2) Predict what will happen to the weight of a semi-permeable bag containing pure distilled water (0% sugar-water solution) when it is put into a beaker of distilled water for 30 minutes. Explain the reason for your prediction.

Scoring Guide:

Key Elements:

- ?? The bag's weight will not change/ will not go up or down.
- ?? The concentration of water is the same inside and outside the bag.

Score Points:

- 2 points = 2 key elements
- 1point = 1 key element

- 3) There are two beakers; one beaker is filled with 15% sugar water and the other with only distilled water. Explain how you could use two identical semi-permeable bags, each filled with the same amount of distilled water, to determine which beaker contains the sugar water.

Scoring Guide:

Key Elements:

- ?? Put one bag in each beaker and wait for a designated period of time.
 - ?? Weigh each bag and compare the weights.
 - ?? The bag with the lower weight came from the sugar water.
- Or
- The bag with the bigger weight did not come from the sugar water.

Score Points:

- 3 points = 3 key elements
- 2 points = 2 key elements
- 1point = 1 key element

- 4) Explain how the balance necessary for life is maintained in cells by processes like those you described in questions 1, 2, and 3.

Scoring Guide:

Key Elements:

- ?? Cells are surrounded by semi-permeable membranes.
- ?? Concentrations of vital nutrients/gases/wastes are regulated by concentration gradients across the cell membrane.

Score Points:

- 2 points = 2 key elements
- 1point = 1 key element

Multiple – Choice Questions

Directions:

Mark the **one** best answer for each question.

A blanket of greenhouse gasses (water vapor, carbon dioxide, and others) covers our planet and is essential for keeping earth warm enough for habitation. The amount of greenhouse gasses in the atmosphere has varied over the earth's 4.5 billion year history. However, scientists are concerned that the continual increase in production of the gas CO₂ by power plants, automobiles, and industrial processes will have long term effects on the equilibrium of this system. The term "Global Warming" is used to describe the correlation between the increase in greenhouse gases and a corresponding increase in average temperature over the past 100 years.

- 1) Greenhouse gases trap heat by
 - A) absorbing ultra violet radiation
 - B) absorbing visible light radiation
 - C) absorbing gamma radiation
 - D) absorbing infrared radiation
- 2) In order to separate the elements of hydrogen and oxygen in a sample of sea water, you would need to
 - A) evaporate the sample
 - B) freeze the sample
 - C) pass an electric current through the sample
 - D) filter the sample
- 3) Since oxygen is such a highly reactive element, the quantity of free oxygen in the atmosphere should quickly deplete through chemical reactions. Luckily for us, evolution has produced a process that replenishes free oxygen and maintains the equilibrium of the system. This process is
 - A) respiration
 - B) decomposition
 - C) photosynthesis
 - D) water cycle
- 4) Many organisms pass on their genetic characteristics to the next generation by producing gametes (sex cells). These cells are unique because
 - A) they contain all the genetic information required to produce the physical characteristics of the organism.
 - B) they contain half the number of chromosomes usually found in a cell of the organism.
 - C) they have no nucleus. DNA is scattered throughout the cytoplasm.
 - D) they are the only cells of an organism that function independently and are not physically connected to tissue.

Vermont-PASS Sample Test

Grade 11 Multiple-choice Questions

- 1) Greenhouse gases trap heat by
- A) absorbing ultra violet radiation
 - B) absorbing visible light radiation
 - C) absorbing gamma radiation
 - D) absorbing infrared radiation**

VT Framework: Universe, Earth, Environment – 7.15 ccc.

NSES: Earth Science 1.4

- 2) In order to separate the elements of hydrogen and oxygen in a sample of sea water, you would need to
- A) evaporate the sample
 - B) freeze the sample
 - C) pass an electric current through the sample**
 - D) filter the sample

VT Framework: Space, Time, Matter 7.12 bbb.

NSES: Physical Science 2.4

- 3) Since oxygen is such a highly reactive element, the quantity of free oxygen in the atmosphere should quickly deplete through chemical reactions. Luckily for us, evolution has produced a process that replenished free oxygen and maintains the equilibrium of the system. This process is
- A) respiration
 - B) decomposition
 - C) photosynthesis**
 - D) water cycle

VT Framework: Living World 7.13 cc.

NSES: Life Science 1.5

- 4) Many organisms pass on their genetic characteristics to the next generation by producing gametes (sex cells). These cells are unique because
- A) they contain all the genetic information required to produce the physical characteristics of the organism.
 - B) they contain half the number of chromosomes usually found in a cell of the organism.**
 - C) they have no nucleus. DNA is scattered throughout the cytoplasm.
 - D) they are the only cells of an organism that function independently and are not physically connected to tissue.

VT Framework: Living World 7.14 aaa., 7.13 aaa.

NSES: Life Science 1.6, 2.2